CHAPTER 5 - ENVIRONMENT CONSEQUENCES

5.1 INTRODUCTION

This chapter discusses the potential environmental consequences which could occur if each of the water supply alternatives was pursued. The components, possible locations, and likely construction measures involved in each of these alternatives are presented in Sections 3.3 through 3.8. The four action alternatives focus on different ways of making more water available to the Maury/southern Williamson County Water Service Area.

Each section in this chapter presents an evaluation of the potential impacts on a resource area that would be likely to occur during the construction and operation of the alternatives as presented in Chapter 3 given the existing state of that resource as presented in Chapter 4. The sections in this chapter address the same topics as those described in Chapter 4 and they are presented in the same order. Within each section, any general discussion is followed by an evaluation of each alternative. These evaluations assume that no changes would have occurred in present laws, regulations, and knowledge about the status of resources in the area. All of the evaluations presented in this chapter are summarized in Section 3.9.

5.2 CLIMATE, GEOLOGY, AND SOILS

The local climate, geology, and general characteristics of the soils in and around the upper Duck River basin would not be affected by construction and operation of any of the water supply alternatives. The presence of sinkholes and cracks in the rocks near the surface and the associated effects on ground water would have to be considered when specific sites and routes were being selected for any facilities that would be built (see Section 5.3) Similarly, soils that contributed to the quality of prime farmland would have to be considered as part of any proposed changes in land use (see Section 5.10).

5.3 GROUND WATER

Sections 4.2 and 4.3 indicate that much of the area which could be affected by the various water supply alternatives is underlain by limestones and dolomites that contain some ground water. Many of the surface rock layers

also contain sinkholes and cracks through which water can move into and out of the ground. Sinkholes and water-conducting channels in the bedrock could make it easy for surface water and a variety of pollutants to get into the ground water. Construction projects involving large areas (such as building or enlarging reservoirs) or extending for some distance (such as building pipelines) could increase the connections between the surface and ground water and could lead to various types of effects. Site-specific planning for any water supply project in this area would have to include a careful evaluation of the potential for leakage into the ground, adverse effects on ground water, and the use of appropriate measures to minimize both of these potential effects. More focused comments about each of the water supply alternatives are presented in the following paragraphs.

Alternative A - Continue to Use Present Sources (No Action)

In comparison with the other options, this alternative might result in the greatest long-term impact on existing groundwater resources. If the future water demand in the Columbia area does exceed what can be withdrawn from the Duck River and no other additional source of water is developed, attempts could be made to withdraw more water from the ground.

As of 1993, ground water supplied less than 10 percent of total public water use in the area (1.66 mgd). Information collected by the USGS (USGS, 1995) suggests that groundwater supplies in or near the project area are not available to meet that much of the future demand for water. Attempts to increase groundwater withdrawals could exceed the recharge capacity of the known water-bearing rock layers and could significantly reduce the amount of available ground water, causing adverse effects to the ground water and existing groundwater users in the area.

Alternative B - Fountain Creek Reservoir

Building a reservoir on Fountain Creek could result in both construction and operational effects on groundwater resources. During the construction period, appropriate erosion and pollution control measures would be required to prevent sediment, trash, and pollutants (e.g. spilled fuel) from flowing into the ground and the ground water. Available information (USACE, 1997b) also suggests that grouting of potential routes into the ground water would be required to slow water losses from the reservoir. All wells in the footprint of the new reservoir also would have to be properly abandoned before the area was flooded.

After the reservoir was filled, the level of water in the ground would be expected to rise. While this could improve the yield of wells in the immediate area, sediment and other materials from the reservoir could degrade the quality of the existing ground water. Grouting to hold more water in the reservoir could prevent or minimize much of this effect.

Alternative C - Downstream Water Intake

Construction of a new water intake and pumping station along the Duck River near the western edge of Maury County and a new approximate 13-mile pipeline and booster station would require that careful attention be given to the presence of potential groundwater access points. Once the proposed structures were properly located and designed, appropriate construction practices could be used to avoid or minimize effects to groundwater resources in the area.

Alternative D - Raise Normandy Pool Level

Raising the height of Normandy Dam by approximately five feet could lead to potential losses of reservoir water to the ground through caves, sinkholes, and cracks in the local bedrock. Losses to the ground water could be slowed or prevented by grouting the likely routes into the ground. Any wells in the expanded reservoir area also would need to be properly abandoned before the higher water level was reached. The use of these preventative measures would minimize or avoid any adverse effects of this alternative on groundwater resources.

Alternative E - Tims Ford Pipeline

The construction of a raw water intake and pumping station along the northern side of Tims Ford Reservoir and an approximate 20-mile pipeline and a booster station to discharge water into the Duck River near Shelbyville would require that careful attention be given to the presence of potential groundwater access points. Once the proposed structures were properly located and designed, appropriate construction practices could be used to avoid or minimize effects to groundwater resources in the area.

Comparison of Alternatives

All four of the action alternatives could be designed, constructed, and operated in ways that would avoid or substantially minimize adverse effects on ground water. Alternatives C and E are likely to have the fewest potential impacts on groundwater resources because both of these projects

could be built and operated in ways that would avoid or minimize any adverse effects on sinkholes or groundwater systems. Alternative B, which would include the construction of a new reservoir, has the potential for more groundwater effects than the modifications to an existing reservoir which would occur under Alternative D. While Alternative A would not have any immediate effects on ground water, it has the potential to impact this resource the most if attempts were made to meet future water needs by withdrawing more water from the limited underground supplies.

5.4 SURFACE WATER

The information presented in Chapter 2 and Section 4.4 describes how the water in the upper Duck River basin is controlled and affected by Normandy Reservoir and the several water supply and wastewater systems that exist all along the length of the river. With that information as a background, it should not be surprising to learn that each alternative which would provide more water for the Columbia area would have some effect on the water resources and water users throughout most of the rest of the basin.

Information presented in Section 4.4 also indicates that the upper Duck River watershed consistently has relatively high levels of nitrogen, phosphorus, iron, and manganese. While all four of these elements are relatively abundant in the rocks and soils in this watershed, nitrogen and phosphorus also are being added to the water from point source discharges, agricultural practices, and other non-point sources. In a few places throughout the upper Duck River watershed, these materials and other pollutants are making the water less than fully suitable for its classified uses (Table 10). The 1996 amendments to the federal Safe Drinking Water Act require water systems to identify source water protection areas, inventory potential sources of contaminants, determine the susceptibility of the water supply to potential contamination, and develop plans to protect their sources from potential contamination. The amendments to that law also require water systems to pay more attention to the chemicals formed when chlorine reacts with natural carbon-containing compounds. These amendments to the Safe Drinking Water Act require water systems to take an active role in making sure the water they distribute is free of watershed-related contaminants that have potential to affect human health.

Three of the action alternatives would involve the construction of some length of pipeline to transfer water from one location to another. The construction of any pipeline could result in temporary adverse effects on the water quality in each stream along its route. As the pipeline is constructed adjacent to or across a stream, the work could cause temporary increases in the amount of suspended solids, sediment, and other materials in the stream. Under each of these alternatives, the location, design, and construction of the pipelines and any other related structures would include measures to avoid or minimize adverse effects on streams and water quality (see Section 3.5). Where the construction of a pipeline and other structures would have to occur in or immediately adjacent to a stream, the work would be planned to minimize the duration of the impact and, when possible, to be conducted during a typically low-flow season of the year.

The following paragraphs present specific reviews of the potential effects of each alternative on surface water resources.

Alternative A - Continue to use Present Sources (No Action)

Under this alternative, no additional source would be developed to meet the projected future water demands of the Maury/southern Williamson County Water Service Area. When required, the existing intake and treatment facilities in Columbia would be expanded or supplemented to withdraw and treat more of the water available in the river. The potential construction-related effects of these activities on surface water probably would be minor, especially if the work was done in compliance with appropriate NPDES permits. If the demand for water did exceed the amount presently allowed to be withdrawn from the Duck River, some action would have to be taken to curtail use or find additional water to meet at least critical needs. One possible way to meet future critical needs would be to request approval from TDEC to reduce the flow in the Duck River below 100 cfs during drought periods. Additional withdrawals from the river would reduce the amount of natural flow in the 6-mile reach between the Columbia Power and Water intake and the wastewater plant discharge (Figure 3). This reduction in flow would allow the water temperature to rise more than normal and the dissolved oxygen level probably would decline. If the reduced flows continued for very long and water quality did decline, impacts could occur to designated uses such as aquatic life and recreation. Over time, if the required volume of additional withdrawals from the river increased as the

need for water continued to grow in the Columbia area, adverse effects on designated uses would occur more often and would be more severe.

Alternative B - Fountain Creek Reservoir

Building a reservoir on the downstream part of Fountain Creek would meet the additional need for water in the Maury/southern Williamson County Water Service Area. The construction and operation of this reservoir also would have a variety of effects on water supply and water quality both in the reservoir area and downstream into the Duck River.

Construction of this reservoir would involve soil disturbance activities on up to 3,600 acres of land and heavy equipment activity adjacent to the streams in the affected part of the Fountain Creek watershed. During the construction period, particular attention would have to be given to the timing of clearing activities, the way earthmoving work was conducted, and how erosion control measures should be used to minimize potentially adverse impacts on water quality in Fountain Creek and the adjacent reach of the Duck River. Careful planning of the various construction stages of the project could minimize water quality impacts by isolating areas before extensive earthmoving work would be done and by rerouting the streamflow into stabilized channels instead of having equipment operate in the flowing water. If this alternative was proposed to be built, the planning leading up to the construction of a reservoir in the Fountain Creek watershed would include a detailed evaluation of ways to minimize adverse effects on the water in the streams passing through the area and the adjacent reach of the Duck River. The results of that planning effort would be reviewed by TDEC, USACE, and other agencies and, if approved, would be addressed in the NPDES permit for the construction work.

Once the reservoir was constructed and filled, the decay of vegetation left in the pool area and the oxygen demand of the flooded soil would reduce the amount of dissolved oxygen in the water during much of the first two or three years. This potential adverse effect could be minimized by removing much of the woody vegetation from the area before the reservoir was filled. That potential water quality benefit might have to be balanced against the potential benefits to aquatic life of leaving some trees in the reservoir (see Section 5.5).

In the summer, the surface water of the reservoir would be warmer and the water on the bottom would be cooler than nearby flowing streams. A water supply reservoir on Fountain Creek would experience strong thermal layering (stratification) similar to that observed in Normandy Reservoir. Reservoirs with low flows and high volumes have low flushing rates, that is the average number of times the reservoir volume is replaced each year. The estimated flushing rate for a Fountain Creek reservoir would be 2.6 times per year while the flushing rate for Normandy is 2.8 times per year. Thus, water quality conditions associated with thermal stratification would be similar for both reservoirs, with conditions in a Fountain Creek reservoir possibly being more severe because of the slower flushing rate. The amount of oxygen in the lower layers of the reservoir probably would begin to drop in early May and there would likely be no oxygen present below a depth of about 15 feet from June to some time in October, when all of the water in the reservoir would mix once again.

Chemical changes associated with the absence of dissolved oxygen on the bottom would cause iron and manganese to become dissolved in the deeper water of the reservoir. There is sufficient iron and manganese in the inflow to the reservoir (0.2 mg/L and 0.095 mg/L, respectively - See Appendix A) to produce high levels in the deeper water during thermal stratification. High levels of dissolved iron and manganese in finished (tap) water can stain laundry and plumbing fixtures. If the water system had to withdraw water from the lower depths of a Fountain Creek reservoir, additional treatment processes would be required to remove iron and manganese from the finished water.

Throughout the life of a reservoir, the amounts of nitrogen, phosphorus, and other nutrients in the water serve to control how much algae are present. Excessive algal growth can cause wide daily variations in pH and dissolved oxygen levels in the upper layers of a reservoir, contribute to oxygen depletion in the deeper water, produce taste and odor in water supplies, and lead to the use of alternative disinfection methods to avoid undesirable reactions of natural carbon-containing substances with chlorine (commonly used in water treatment processes). Information presented in Section 4.4 indicates that the Fountain Creek watershed contains relatively high levels of nitrogen and phosphorus from natural sources, as well as non-point sources. These nutrient levels would be quite likely to support excessive algal growth in the upper layers of the reservoir.

The combination of excessive algal growth in the upper layers of the water and high concentrations of dissolved iron and manganese in the water near the bottom would make it important for the water system to be able to withdraw water from a variety of depths. The construction and use of a multi-level intake structure in the deepest part of the reservoir would make it possible for the water system to withdraw the best quality water that was available and minimize this potential adverse effect. The multiple levels in the intake structure also would have to be used as the reservoir was drawn down during the drier months of normal years and, especially, during drought conditions.

A Fountain Creek reservoir would be relatively small in comparison to most reservoirs in the Tennessee River system. For example, it would hold about 1/3 the volume of water as Normandy Reservoir, also one of the smaller reservoirs in the system. Because of its relatively small volume, the water would be very susceptible to contamination from pollution sources. Recent amendments to the Safe Drinking Water Act would require a water system withdrawing from a Fountain Creek reservoir to prepare a source water assessment and to protect the water source from potential contaminants. On a reservoir the size of Fountain Creek, source water protection actions might need to include reducing agricultural and other types of non-point source pollution in the watershed, restricting recreational uses which could cause contamination of the water, and controlling activities on the land around the reservoir to prevent the introduction of more contaminants such as nutrients and bacteria. The potential for contaminant effects on the water supply and the ramifications of various ways to avoid those effects would have to be important parts of a more detailed evaluation of this alternative if it was proposed to be built.

The dam probably would have to provide a continuous release of at least five cfs of water to maintain water quality and support aquatic life in the downstream reach of Fountain Creek. That amount of minimum release, which would be approximately three times the natural 7-day, 10-year minimum flow in Fountain Creek, could improve water quality in the downstream part of the creek. Careful planning about the amount and quality of this water would be important to avoid adverse effects on aquatic life in the tailwater of this dam and in the adjacent reach of the Duck River.

If this alternative resulted in a net increase in the amount of water in the Duck River at Columbia, it would have a positive effect on water quality in the river. If, for example, all of the future water demand of the Columbia area were to be met from the Fountain Creek reservoir, there could be at least 43 cfs of additional flow in the river as it passed through town (Figure 5). The additional flow would help maintain acceptable water quality conditions for fish and aquatic life and recreational uses downstream from the existing water intake, as well as provide more initial dilution for the discharge from the Columbia wastewater treatment plant. This increase in initial dilution also would help maintain reasonable wastewater treatment costs for Columbia.

In summary, construction and use of a Fountain Creek water supply reservoir would create a relatively small, nutrient-rich reservoir which probably would have to be carefully monitored and the watershed strictly managed to protect the quality of the source water. Water suitable for domestic use could be withdrawn from this reservoir if a multi-level intake structure was built and used to select the best water available from the various layers in the reservoir. This reservoir would not have any adverse construction or operational effects on water quality in the downstream reach of Fountain Creek or the adjacent reach of the Duck River if appropriate erosion and pollution measures were taken while the project was being built and if water for the minimum release was drawn from appropriate layers in the reservoir pool.

Alternative C - Downstream Water Intake

Construction of a new water intake and pumping station on the Duck River downstream from the mouths of Big Bigby and Catheys creeks and an approximate 13-mile pipeline and booster station to transport water to a new treatment plant and the existing distribution system could affect surface water quality in the Duck River adjacent to the intake site and in the various other streams that would be crossed by the pipeline. If these structures were built as described in Section 3.4, the construction effects on surface water would be only minor and temporary.

If this downstream intake was built, future water demands above the likely maximum capacity of the existing water treatment plant (30.8 cfs) would be met using water withdrawn at the downstream site. At that site, Big Bigby Creek, Catheys Creek, and other tributaries would have added at least 11

cfs of additional flow to the river, in addition to the water that would be returned to the system from the Columbia and Spring Hill wastewater treatment plants (Figure 7). The likely location of this intake is more than 25 river miles downstream from the Columbia wastewater treatment plant discharge (Duck River Mile 127.2) and at least 20 miles downstream from the industrial wastewater discharge on Big Bigby Creek (Creek Mile 15). At present, these well-treated effluents make up about 6 percent of the minimum flow near River Mile 100. The percentage from the Columbia wastewater treatment plant is projected to increase to 15 percent of the minimum flow by the year 2050. The Duck River near River Mile 100 presently meets all applicable water quality criteria and is classified for domestic water supply use. Previous water quality studies on the Duck River indicate that, even during low flow conditions, the wastewater from Columbia is completely assimilated in the 2.5 days it takes to reach Duck River Mile 116.0 (TVA, 1986).

Leaving additional water in the Duck River between the existing Columbia intake and the wastewater discharge would improve water quality conditions in that part of the river. Water quality in the river reach downstream from the wastewater discharge would be especially benefited by having more water available for initial dilution of the treated effluent.

Alternative D - Raise Normandy Pool Level

Increasing the amount of water that could be stored in Normandy Reservoir would require the dam and a variety of other structures on the reservoir to be raised by that same height. Construction activities associated with, or required by, raising the dam include adding a large volume of earth fill and riprap on the dam, rebuilding the roadway at the dam, raising the Riley Creek Road bridge and approaches, and raising or replacing a variety of roads, structures, and other facilities at existing recreation areas. The use of best management practices would be required at each of these construction sites to control runoff and prevent soil erosion which could adversely affect water quality in the reservoir or the tailwater.

Raising the level of the Normandy pool also would affect the immediate shoreline of the reservoir which, now, is typically covered with trees and woody vegetation. Virtually all of the vegetation would be cleared within the band of present shoreline that would become part of the higher reservoir pool. If the clearing of this area was conducted in ways that would

minimize erosion and sedimentation effects on the reservoir, it would minimize the potential for impacts on surface water quality. This would include making appropriate decisions about what to do with the cleared debris, taking into account its potential to increase nutrients and oxygen demand if some or all of that material was placed in the reservoir.

If the Normandy pool level was raised and an additional 16 cfs of water was discharged from the dam during the summer months, water quality conditions in the reservoir and the tailwater would change but, perhaps, only slightly. The larger discharge from the dam would tend to increase the flushing rate and reduce the volume of the cooler water in the lower layers of the reservoir. In the tailwater, the additional flow would not change water quality conditions near the dam; however, the cooler water from the dam discharge would affect a slightly longer reach of the river. Under extremely dry conditions, all of the cooler, low dissolved oxygen water in the bottom layer of the reservoir might be discharged, which would result in higher temperatures and other water quality changes in the tailwater. Further downstream from Normandy Dam, the additional 16 cfs of minimum summer flow in the river would provide some water quality benefit to the Shelbyville wastewater discharge (at River Mile 221.3) by providing more initial dilution for the treated wastewater. If this alternative is proposed to be built, detailed modeling studies of the proposed operating conditions might be required to determine how much water quality in the reservoir and the dam tailwater could change during typical and extremely wet or dry years.

At present, Normandy Reservoir is the most important water supply source in the upper Duck River watershed. If this alternative is proposed to be built and Normandy Reservoir is to provide more of the water used in this region, the protection of water quality in the reservoir would have to become a priority for each of the water systems it serves. Under the 1996 amendments to the Safe Drinking Water Act, each of the downstream water systems should take an active role in a source water assessment program for Normandy Reservoir. Such a program could help prevent impacts caused by agricultural non-point sources, residential shoreline development, other forms of urban or industrial development, and any other potential threats to water quality. In addition, the downstream water systems should exert leadership to improve and protect water quality in the Duck River from bacterial contamination, agricultural non-point sources, or

other potential impacts that exist in Bedford County, Marshall County, and the upstream part of Maury County.

Alternative E - Tims Ford Pipeline

This alternative could affect surface water quality during the construction of the intake, pump stations, and discharge structure; during the construction of the pipeline; and when this facility was moving water from Tims Ford Reservoir to the Duck River. The use of appropriate erosion and pollution prevention measures described in Section 3.4 would reduce the potential construction impacts to short-term and minor effects on water quality.

Water quality in both the Lost Creek and Hurricane Creek embayments would be suitable for water supply use. Neither Hurricane Creek or Lost Creek is presently classified for domestic water supply use; however, the Tennessee Water Quality Control Board could be petitioned to add that use to the classification for both of these streams. Operators of the Jack Daniel Distillery/Lynchburg joint water intake on the Lost Creek embayment report mostly favorable water quality conditions except during short time periods in the spring and late fall as a result of thermal stratification. Like Normandy Reservoir, Tims Ford Reservoir experiences strong thermal stratification, and the two embayments would become thermally stratified from May into October each year. To avoid potential problems associated with thermal stratification, the new intake would have to be able to withdraw water from various depths in the water column. No quality characteristics of the water in Tims Ford Reservoir would be incompatible with water quality in the Duck River.

If this transfer system was built, water probably would be withdrawn from Tims Ford Reservoir only during extreme dry periods which, in the upper Duck River watershed, typically occur in July through part of October. The results of initial modeling studies conducted by TVA indicate that if a water intake had been withdrawing 22 cfs from Tims Ford Reservoir during the severe drought which occurred in the region in 1987-1988, the water elevation in Tims Ford Reservoir would have been lowered 7 to 8 inches by the end of October each year. In future years, part of this estimated reduction in the Tims Ford elevation could be offset by an increase in the volume of water now discharged into the reservoir from the Tullahoma wastewater treatment plant. Tullahoma purchases water from the Duck River Utility Commission which withdraws water from Normandy Reservoir.

Tullahoma discharges treated wastewater into Rock Creek, a tributary to the Elk River which drains into Tims Ford Reservoir (at Elk River Mile 161.8). If Tullahoma grows and expands its wastewater collection system as anticipated, the additional wastewater discharged into Rock Creek could offset some of the reduction in the Tims Ford Reservoir elevation associated with this proposed withdrawal. If this alternative was proposed to be built, updated modeling studies should be conducted to confirm the possible effects on the elevation in Tims Ford Reservoir.

In the Duck River, the water from Tims Ford Reservoir would augment the existing flow only during extreme drought conditions (Figure 11). If this water was discharged upstream from Shelbyville, it would provide some water quality benefit to the Shelbyville wastewater discharge (at River Mile 221.3) by providing more initial dilution for the treated wastewater.

As indicated under Alternative D, the protection of water supply sources would have to become a priority for each of the water systems in this part of the basin. Under the 1996 amendments to the Safe Drinking Water Act, each of the downstream water systems would need to assure that each of its sources (in this case including Tims Ford Reservoir) was protected from agricultural non-point sources, residential shoreline development, other forms of urban or industrial development, and any other potential threats to water quality. In addition, the downstream water systems should exert leadership to improve and protect water quality in the Duck River from bacterial contamination, agricultural non-point sources, or other potential impacts that exist in Coffee, Bedford, Marshall, and Maury counties.

Comparison of Alternatives

The information about the potential effects that could occur if each alternative was proposed to be built also can be used to compare them. The construction of either Alternative C (Downstream Water Intake) or Alternative E (Tims Ford Pipeline) would have less potential for adverse impacts because both of these alternatives would result in only short-term and localized effects on surface water quality. Raising the Normandy Pool Level (Alternative D) would have more potential for construction impacts on surface water quality because of the larger scope of disturbance activities at the dam, along roadways, at a variety of recreation areas, and associated with clearing and inundating part of the existing shoreline. The construction of a new reservoir on Fountain Creek (Alternative B) would

involve the most disturbance of the land; would convert a free-flowing stream into a shallow, nutrient-rich reservoir; and would result in the most impacts on surface water quality of any of the action alternatives.

Even at the end of the planning period (around 2050), operation of all of the action alternatives would increase the minimum flow and, probably, improve water quality conditions in various lengths of the Duck River beyond what it would be under the No Action Alternative (Alternative A). Releasing more water from Normandy Dam (Alternative D) or moving water into the Duck River from Tims Ford Reservoir (Alternative E) would increase the flow by between 16 and 22 cfs along at least 85 miles of the river upstream from the Columbia water intake. Alternative E would maintain at least 100 cfs of flow in the river downstream from the water intake. Meeting all of the water needs of the Columbia area from a new reservoir in the Fountain Creek watershed (Alternative B) would result in a minimum flow of 137 cfs in the river from the existing Columbia water intake downstream to the wastewater discharge. Alternative B also would provide sufficient flows to meet water quality needs at both the Columbia water intake and wastewater discharge sites. Withdrawing some water at a downstream location (Alternative C) would involve the least modification in river flows but would allow at least 110 cfs of water to be left in the river downstream from the Columbia water intake.

Deciding to follow Alternative A (No Action) would not result in any construction-related impacts on surface water quality because no facilities would be built to provide an additional water source for the Columbia area. If the demand for water did exceed the amount presently allowed to be withdrawn from the Duck River, whatever action was taken to meet the future needs could result in some adverse effects on surface water quality.

5.5 AQUATIC LIFE

The information presented in Section 4.5 indicates that the streams and reservoirs in this project area support many types of aquatic life, as many as 436 species in the middle reach of the Duck River. Section 4.5 also indicates that the habitats and numbers of species vary quite a bit, ranging from small creeks and the reservoirs where relatively few species occur to the downstream and middle reaches of the Duck River where many species exist in a variety of flowing-water habitats. The different types of aquatic

habitats and diversity of aquatic life that occurs throughout this area would be affected in a variety of ways by the five water supply alternatives.

Three of the four action alternatives include the construction of some length of a pipeline to transfer water from where it was available to where it would be used. As indicated in Section 3.4, specific techniques would be used during the construction of these pipelines that would avoid or minimize potential adverse impacts on streams. If the route of the pipeline was carefully located, designed, and constructed, adverse impacts to streams and aquatic life would be minimal and would occur only during short periods of time. The subsequent review of more detailed plans for any of these alternatives proposed to be built would confirm or address the anticipated low level of construction effects.

Once it was built, each action alternative would be operated to hold water somewhere or move water from one location to another so it could be used to meet a water supply need. Each of these proposed changes in water flow also would have some effect on aquatic habitats and aquatic life, both at the source and in any receiving stream. The level of effect these changes could have on aquatic life would depend on when the transfer would occur during the year, how much the flow would be changed, and whether the change would modify the temperature and other water quality conditions. Most of the time, the volume of water that would be removed or introduced would be very small in comparison with what was left or was there initially. However, when the flow in a stream was extremely low (for example, during drought conditions), the amount being withdrawn or added could have important effects on the resident aquatic life.

The following paragraphs describe the potential effects of each alternative on aquatic life. The concluding paragraph in this section presents a summary and comparison of these potential effects.

Alternative A - Continue to use Present Sources (No Action)

If this alternative was followed, no additional source of water would be developed to meet the projected future needs of the Columbia area. Initially, this alternative would not have any effect on aquatic life because no structures would be built. Existing water quality and habitat conditions in the streams within this project area would not be changed from the way they are now. However, if the projected increased demand for water in the

Columbia area did occur at some time in the future, action would have to be taken to meet at least the critical needs for water. The most accessible way to meet a critical water need probably would be to withdraw more water from the Duck River than is presently allowed to be removed. As described in Section 5.4, the additional withdrawals from the Duck River could reduce the rate of flow in the six-mile reach between the intake and wastewater discharge (Figure 3), probably allow the water temperature to rise more than normal in that reach, and cause the dissolved oxygen level to drop. These water quality effects would stress aquatic life in the area and, under very low flow conditions, could result in fish kills and other losses in the aquatic life. These impacts could be minimized or avoided by finding other water sources to meet the future needs of the Columbia area.

Alternative B - Fountain Creek Reservoir

Construction of a reservoir in the Fountain Creek watershed would involve considerable modification of the aquatic habitat in the project area. Actual construction of the reservoir would require extensive modification of the land adjacent to the streams. These construction effects would allow more sunlight to raise the temperature of the water, increase the amount of sediment and nutrients in the streams, and result in the modification or destruction of the stream habitats. To minimize adverse effects on aquatic life in the reach of Fountain Creek downstream from the project area and in the adjacent reach of the Duck River, careful attention would have to be given to the timing of clearing activities, the way earthmoving work was conducted, and how erosion control measures should be used. These measures probably would become requirements included in the NPDES or other permits for the construction work.

After the reservoir was filled, the stream-dwelling aquatic life in the project area would be replaced by species capable of living in the standing-water habitats of a reservoir. More than likely, the 182+ species now living in the downstream part of the Fountain Creek watershed would be replaced with an aquatic community similar to the 44+ to 48+ species known to occur in Normandy and Tims Ford reservoirs. A reservoir on Fountain Creek would probably have an abundant plankton community, a bottom community composed of just a few types of insects and other tolerant species, and a fish community composed of a few plankton feeders and a few predatory species. Some of these species could become relatively abundant,

depending upon the nutrients available in the water and how the reservoir was managed.

If the reservoir was required to provide some minimum flow into the short reach of Fountain Creek downstream from the dam site, aquatic life in that area and in the adjacent reach of the Duck River would be affected by the temperature and quality of the water being released. If the dam release was consistently colder or warmer than it is now, if it had low dissolved oxygen levels, or if it contained large amounts of dissolved iron, manganese, or other materials not typically found now in Fountain Creek, the aquatic community would likely be different from what occurs there now. If all of the water needs of the Columbia area were met by withdrawing water from a Fountain Creek reservoir, the minimum flow in the Duck River, especially in the 6-mile reach between the present water intake and the wastewater discharge point, would be substantially higher than it would be under Alternative A (Figure 5). Aquatic life in that part of the river and in the river reach downstream from the wastewater discharge would benefit from the higher flow, increased water quality conditions, and increased dilution of the wastewater discharge (see Section 5.4). If this alternative was proposed to be built, careful planning would have to be given to the location, design, and operation of the discharge to minimize the potential for adverse effects on aquatic life in the downstream part of Fountain Creek and the adjacent reach of the Duck River. The results of this effort also probably would become a requirement included in the TDEC Aquatic Resource Alteration Permit for this project.

Alternative C - Downstream Water Intake

Construction of an intake and pumping station on the Duck River somewhere near River Mile 100 and a 13-mile pipeline and booster station from the intake site to somewhere in the Columbia area could have adverse impacts on aquatic life in the river and in each of the tributary streams that would be affected. However, if the intake facilities and pipeline route were located appropriately and the construction techniques described in Section 3.4 were followed, this alternative could be built with only minor and short-term effects on aquatic life. The subsequent review of detailed plans for this project would confirm or address the minimal construction effects on aquatic life that are likely to occur.

The withdrawal of as much as 31 cfs of water from the Duck River downstream from the mouths of Big Bigby and Catheys creeks would not have an adverse impact on aquatic life in that part of the river. As indicated in Section 3.4, the minimum flow in that reach of the river is approximately 147 cfs and, even during drought conditions, the withdrawal would amount to 21 percent of the flow. This modest reduction in the minimum flow (down to 116 cfs), would not be likely to change the characteristics of any habitats in the river or cause adverse effects on aquatic life.

Aquatic life living in the 30-mile reach of the Duck River between the Columbia water intake and the mouth of Catheys Creek could benefit if this intake and other area water-related facilities were used appropriately. Water withdrawn near Duck River Mile 100 would make it possible for at least 100 cfs of flow to be left in the river between the existing intake at River Mile 133 and the wastewater treatment plant at River Mile 127 (Figure 7). This amount of flow would help aquatic life process the nutrients in the wastewater discharge more quickly than would occur under Alternative A (No Action).

Alternative D - Raise Normandy Pool Level

Modifying the height of Normandy Dam, raising the pool level in Normandy Reservoir, and increasing the minimum flow in the tailwater could have a variety of effects on aquatic life, both in the reservoir and downstream in the river. The general nature of most of these effects can be predicted based on the description of this alternative presented in Section 3.5; however, these generalities should be confirmed or amended as part of the subsequent evaluation of a more detailed plan if this alternative is proposed to be built.

Construction effects on aquatic life likely to be associated with this alternative include temporary habitat disruptions and sedimentation effects that could occur during almost any project. In this case, the construction impacts could occur when the dam was modified, when roads and bridges were being raised, when recreation facilities were being modified or relocated, and when the shoreline vegetation was being removed in preparation to be flooded. Adverse impacts to aquatic life in the tailwater and the reservoir could be avoided or minimized with the use of appropriate measures to control erosion and sedimentation.

Raising the elevation of Normandy Reservoir could have a variety of effects on the aquatic life living in the reservoir pool. Some of the potential effects on aquatic life would be caused by changes in the operational plan dictating how water would be held and discharged. The range of possible changes in the flushing rate and the amount of cooler, low dissolved oxygen water in the lower layers of the reservoir are discussed in Section 5.4. Any substantial change in water quality conditions in the reservoir would affect the amount of habitat available to support fish and other aquatic life. Similarly, the suitability of the band of new shoreline habitat around the reservoir would be affected by the kinds and amount of trees and other material that would be left there when it was flooded. Raising the maximum pool level also could change the amount of shallow water habitat that would be available when different fish and other species were spawning. If this alternative was proposed to be built, the subsequent review would include a careful evaluation of changes in the operational plan for the reservoir and the effects those changes would have on water quality, aquatic habitats, and aquatic life in the reservoir pool.

Increasing the minimum flow in the discharge from Normandy Dam would benefit aquatic life in the Duck River downstream from this dam. In the first few miles downstream from the dam, the minimum flow determines how much bottom habitat is always available for use by aquatic life. Further downstream, the minimum flow from the dam continues to provide some stability in the amount of bottom habitat, especially during drought conditions. If the minimum flow was increased, more habitat would be available and more aquatic life could live there. One possible negative effect of maintaining a higher minimum flow from Normandy Dam (described in Section 5.4) would be the possibility that all of the cooler water in the bottom layer of the reservoir could be discharged before the end of a particularly dry summer. If that occurred, coldwater conditions in the first few miles of the dam tailwater would not be maintained and aquatic life adapted to those conditions (such as rainbow trout) might not be able to survive there. If this alternative was proposed to be built, modeling studies might be required to determine how often water quality conditions in the tailwater could change enough to adversely affect resident aquatic life adapted to coldwater conditions.

Alternative E - Tims Ford Pipeline

The construction of an intake and pumping station on a northern embayment of Tims Ford Reservoir and an approximate 20-mile pipeline (with a booster station) to discharge water into the Duck River somewhere near Shelbyville could affect aquatic life adjacent to the intake site in the reservoir, in the streams along the pipeline route, and in the Duck River at the discharge location. If the pipeline route essentially followed State Highway 82 towards Shelbyville, the effects of pipeline construction could occur in part of the East Fork Mulberry Creek watershed and at several sites all along the length of the Flat Creek watershed. If the intake facilities and pipeline route were located appropriately and the construction techniques described in Section 3.4 were followed, this alternative could be built with only minor and short-term effects on aquatic life. The subsequent review of detailed plans for this project would confirm or address the minimal construction effects on aquatic life that are likely to occur. Avoiding or effectively minimizing adverse impacts on aquatic life at each potential impact site would be much more important in the Flat Creek basin because the pipeline could affect several sites in that small watershed.

An intake structure could be built in either of the two northern embayments of Tims Ford Reservoir (Hurricane Creek and Lost Creek embayments) with little or no adverse effect on aquatic life. Much of the work could be scheduled to occur when the reservoir was at winter pool, and lower elevation work probably would occur during a short-term drawdown. Aquatic life in Tims Ford Reservoir is adapted to periodic fluctuations in the water level and would not be adversely affected by this construction activity.

Construction of the discharge structure on the Duck River also could be completed without significant or long-term effects on aquatic life. The location and design of the discharge structure would have to include some consideration of river bank stability in the area where it would be built. Actual construction of the discharge structure also would have to be planned to occur during low flow conditions and to include ways to prevent erosion and sedimentation effects on aquatic life.

As indicated in Section 3.7, this water transfer system would likely be used only during severe drought conditions in the Duck River watershed and, as described in Section 5.4, would be likely to reduce the elevation in Tims

Ford Reservoir by no more than seven or eight inches. That amount of water level reduction would not have any adverse effect on aquatic life in Tims Ford Reservoir.

When this transfer system was operating, it would add approximately 22 cfs of flow to the Duck River somewhere near Shelbyville (Figure 11). This additional flow would supplement the 165 cfs of minimum flow being discharged from Normandy Dam. This new level of minimum flow during drought conditions would benefit aquatic life in the river. If this additional flow was added upstream from the Shelbyville wastewater discharge (River Mile 221), it would help aquatic life process the nutrients in the discharge more quickly. The increased minimum flow also would mean that more of the river bed would always be under water, making slightly more habitat available for aquatic life.

Comparison of Alternatives

Based on the available information about the intent and general concepts of each alternative, Alternatives C, D, or E probably could be constructed with only minimal and short-term adverse effects on aquatic life in local areas. For each of these alternatives, however, a careful review of the location, design, and proposed construction techniques associated with each component would be required to confirm that no avoidable or long-term effects on aquatic life would occur. Alternative A would not have any adverse construction effects on aquatic life because no water supply facilities would be built. The construction of a reservoir in the Fountain Creek watershed (Alternative B) would adversely affect the resident aquatic life in the project area; however, the use of appropriate erosion and pollution control measures could prevent or minimize adverse effects in the downstream reach of Fountain Creek and the adjacent reach of the Duck River.

The most significant operational adverse effects on aquatic life associated with any of these alternatives would occur under Alternative B (Fountain Creek Reservoir). The relatively large number of aquatic species now living in flowing-water habitats in part of the Fountain Creek watershed would be replaced by considerably fewer species adapted to life in the standing-water conditions in the reservoir. Species capable of living in the reservoir would become more abundant in the area because up to 2,200 acres of terrestrial habitats would be converted into standing water. Alternatives D and E

would both have the potential to affect aquatic life in an existing reservoir; however, the effect of Alternative E on aquatic life in Tims Ford Reservoir probably would be substantially less than the effect of Alternative D on aquatic life in Normandy Reservoir.

Away from the reservoirs, operational effects of the action alternatives on aquatic life probably would be beneficial because each alternative would tend to increase minimum flows in various reaches of the Duck River. Alternative B could result in substantially increased flows in the part of the river which passes through Columbia and could benefit aquatic life in that area. Alternatives D and E would result in smaller increases in flows and benefits to aquatic life in the Duck River from Normandy or the discharge point near Shelbyville downstream to the Columbia water intake. Alternative C would result in increased flows and benefits to aquatic life from the Columbia water intake downstream to near River Mile 100 and, more than likely, only insignificant decreases in the flow and no detectable adverse effects on aquatic life downstream from there.

5.6 WETLANDS

Preliminary information about the types and locations of wetlands present in areas that could be affected by the action alternatives is presented in Section 4.6. That section also describes the federal and state laws and regulations which protect wetlands: Section 404 of the Clean Water Act, Executive Order 11990 (Protection of Wetlands), and the Tennessee Water Quality Control Act of 1977.

Three of the action alternatives include the potential to affect wetlands during the construction of pipelines. The types of impacts that could occur include vegetation removal, temporary removal of soils, sedimentation, soil compaction, and alteration of drainage patterns. If a pipeline is properly sited, designed, and constructed, it should have few or no adverse impacts on wetlands. The impacts that might occur would be greatest during and immediately following construction of the pipeline. In emergent wetlands, the construction impacts would be relatively brief because the non-woody vegetation would regenerate quickly. In forested and scrub-shrub wetlands, the impacts would last longer because woody vegetation takes longer to re-establish.

All proposed wetland impacts would be subject to the requirements of state water quality regulations; a Section 404 permit issued by the USACE; and, if federal funds are involved, compliance with the wetlands Executive Order. Mitigation to offset wetland impacts might be required, depending on the amount and types of wetlands that would be affected. That mitigation would have to be completed in accordance with permit requirements after consultation with the USACE. The functions of disturbed or modified wetlands would be expected to return over time, as wetland hydrology is restored and natural revegetation and succession occur.

Alternative A - Continue to Use Present Sources (No Action)

This alternative would not have any effect on wetlands because no facilities would be built to provide additional water for the Columbia area. If the demand for water increases as expected in future years, additional withdrawals from the Duck River or whatever other alternatives are developed might eventually have some effect on wetlands.

Alternative B - Fountain Creek Reservoir

The construction of an impoundment in the Fountain Creek watershed as described in Section 3.4 would inundate approximately 200 acres of palustrine forested wetlands and approximately 25 acres of mixed palustrine forested and scrub/shrub wetlands. Once the reservoir was filled, some new wetland areas would likely develop in the area, particularly along the shorelines of embayments and in tributary bottomlands. While it is difficult to predict the types and extent of the new wetlands which would develop, it is likely they would not perform the same level of ecological function as the wetlands which would be lost. If that is true, construction and operation of this alternative would result in a net loss of wetland functions in the project area and would require mitigation as directed by the USACE and state water quality regulations administered by TDEC.

Alternative C - Downstream Water Intake

Construction of a new intake and pumping station on the Duck River and an approximately 13-mile pipeline and booster station has the potential to affect some known wetlands in the area. Proper siting, design, and construction of the facilities would substantially reduce or eliminate the potential for adverse impacts on wetlands. A review of the potential for wetlands impacts would be part of the subsequent evaluation of detailed plans for this project if this alternative is proposed to be built.

Alternative D - Raise Normandy Pool

Raising the water level in Normandy Reservoir by approximately five feet would inundate several forested wetlands that now occur at the upstream ends of some reservoir embayments. In the short term, although some of these areas could be flooded more than many wetland species can tolerate, the effect in these embayments might not result in the loss of the present communities. Small increases in water levels could expand the zone of soil saturation in some riparian and shoreline areas, particularly along embayment shorelines and tributary bottomlands. Over the long term, if these areas were wet long enough during the growing season, the wetland boundary could expand in these areas. If this alternative was proposed to be built, confirmation of this likely result on wetlands would have to be conducted as part of the subsequent evaluation of the detailed plans for the project.

Alternative E - Tims Ford Pipeline

Construction of a new intake and pumping station on Tims Ford Reservoir and an approximately 20-mile pipeline to the Duck River near Shelbyville have the potential to affect some known wetlands in the area, especially along Flat Creek. Building this alternative could have few or no adverse impacts on wetlands if the facilities are properly sited, designed, and constructed.

This alternative also would result in a slightly lower pool level within Tims Ford Reservoir during a severe drought event; however, the change would be within the normal annual and seasonal variability in lake level and is no different from the range of conditions under which the wetlands have developed in these areas. Therefore, this alternative would have little or no adverse effect on the wetlands around the margins of Tims Ford Reservoir.

Comparison of Alternatives

Four of the five alternatives (Alternatives A, C, D, and E) are likely to result in few or no adverse impacts to wetlands. Most impacts associated with these alternatives would be temporary and associated with the various aspects of pipeline construction. Construction of a reservoir on Fountain Creek (Alternative B) would displace approximately 225 acres of forested and scrub/shrub wetlands. Even assuming that new wetlands would develop around the edge of the reservoir and mitigation requirements would be met, building Alternative B is likely to result in a net loss of wetland

acreage and wetland functions. That loss would have to be mitigated as part of the project.

5.7 FLOODPLAINS/FLOOD CONTROL

As indicated in Section 4.7, Maury, Marshall, and Moore counties, and Columbia and Shelbyville participate in the National Flood Insurance Program (NFIP) and have adopted the 100-year flood as the basis for their local floodplain regulations. Bedford and Coffee counties do not participate in the NFIP. The construction of any project in the floodplain would have to comply with applicable local floodplain regulations. Under these regulations, development in the floodplain that would be subject to flood damage must be elevated so that it would be a minimum of one foot above the 100-year flood elevation at that location. Under the NFIP, any activities that would include construction in a floodplain or floodway would have to be approval by the local floodplain administrator before construction started.

As indicated in Section 1.8, any project involving federal funds also would be subject to the requirements of Executive Order 11988 (Floodplain Management). This Executive Order states that all proposed facilities must be located outside the limits of the 100-year floodplain unless an evaluation supports a determination of "no practicable alternative" to siting within the floodplain. If this determination can be made, adverse floodplain impacts would have to be minimized during design of the project.

Because water supply is the purpose of this project, each of the action alternatives is likely to involve the construction of an intake, a pipeline, or some other types of structures in the floodplain of one or more streams. There would be no practicable alternative to the construction of these types of structures in floodplains. To comply with the Executive Order, water intakes and discharges in floodplains would have to be designed and built so they would not be damaged during a flood. The pipelines also would be constructed using best management practices, revegetated where natural vegetation is removed, and the corridor would be returned to pre-construction conditions after completion of the project.

Pumping stations, water treatment plants, and other structures that might not have to be located in a floodplain would either be built outside of the

100-year floodplain or alternatives would be evaluated and documented to support a determination of "no practicable alternative" to siting them in the floodplain. If a floodplain location was selected for any part of a proposed project, items and/or equipment subject to flood damage would have to be either located above the 100-year flood elevation or floodproofed consistent with local floodplain regulations. The intent of these commitments is to make sure that any project which is constructed complies with all of the requirements of Executive Order 11988 and the National Flood Insurance Act.

The following paragraphs describe floodplain and flood control aspects of each of the water supply alternatives.

Alternative A - Continue to Use Present Sources (No Action)
This alternative would not have any effect on floodplains or flood elevations in the study area because no new water supply facilities would be constructed. Floodplains in the area would continue to be protected from, or impacted by, ongoing activities and development projects not related to water supply activities described in this EIS.

Alternative B - Fountain Creek Reservoir
Under this alternative, the construction of a new reservoir, a water intake, and most of a five-mile pipeline probably would take place within the limits of the 100-year floodplain. These structures would be constructed in ways that would minimize adverse impacts to floodplains and, specifically, would comply with requirements of the National Flood Insurance Act and, if appropriate, Executive Order 11988. Construction of the dam would increase flood elevations upstream along Fountain Creek and several of its tributaries. These new flood elevations would be determined and mapped. Land that would be located below the top of the dam or within a selected floodplain would be purchased or flood easements would be obtained to prevent flood damages on non-project lands.

Downstream from the dam, flood elevations along the short reach of Fountain Creek and part of the Duck River downstream from the mouth of Fountain Creek could be reduced because a large volume of water could be held in the reservoir. If necessary, revised 100-year flood elevations for these areas would be developed and provided to Maury County and Columbia for their use. Studies also probably would be performed to

determine the potential impacts of a failure of the new dam and to document that the project would comply with all state and local dam safety requirements.

Alternative C - Downstream Water Intake

Construction of the intake and at least parts of the 13-mile pipeline would occur in floodplains of the Duck River and other streams. If this alternative was proposed to be built, all of the project components would be located, designed, and constructed in ways that would minimize adverse impacts to floodplains and, specifically, would comply with requirements of the National Flood Insurance Act and, if appropriate, Executive Order 11988.

Alternative D - Raise Normandy Pool Level

Under this alternative, the height of Normandy Dam would be raised and additional water would be stored in the reservoir which could be released to increase the summer season minimum flow in the Duck River. If the dam was raised by five feet, the normal maximum reservoir elevation could be increased from 875 feet to 880 feet.

If this alternative was proposed to be built, studies would be performed to determine the new full-pool elevation of the reservoir and the anticipated flood elevations upstream from the dam. The results of these studies would indicate if any additional land rights would have to be obtained to control development and prevent an increase in upstream flood damages as a result of this project. These results also would indicate if existing structures around the reservoir would have to be relocated or floodproofed to remain in compliance with local regulations.

Downstream from the dam, present flood elevations might be reduced because of the larger storage volume that could be held in the reservoir. If necessary, revised 100-year flood elevations for these areas would be developed and provided to Bedford County and Shelbyville for their use. Studies also would be performed to determine the potential impacts of a failure of the modified dam and to document that the project would be consistent with all state and local dam safety requirements.

Alternative E - Tims Ford Pipeline

Under this alternative, a raw water intake and pumping station would be constructed on either of two northern arms of Tims Ford Reservoir and an

approximate 20-mile pipeline would be built to discharge water into the Duck River near Shelbyville. If this alternative was proposed to be built, all of the project components would be located, designed, and constructed in ways that would minimize adverse impacts to floodplains and, specifically, would comply with requirements of the National Flood Insurance Act and, if appropriate, Executive Order 11988.

Federal funds could not be used in constructing the pipeline and the discharge structure on the Duck River unless Bedford County decides to participate in the NFIP. The National Flood Insurance Act provides that "[n]o Federal officer or agency shall approve any financial assistance for acquisition or construction purposes" for use in a floodplain unless the community is participating in the NFIP (42 U.S.C. § 4106).

Comparison of Alternatives

Among the alternatives, Alternative A (No Action) would not have any impact on floodplains and flood control because no additional water source would be developed, at least initially. Alternatives C (Downstream Water Intake) and E (Tims Ford Pipeline) are likely to have negligible impacts on flood elevations and floodplain values. The pipelines that would be built under those alternatives would not result in adverse floodplain impacts because disturbed areas would be returned to pre-construction conditions after completion of the project. Proposing to build Alternative D (Raise Normandy Pool Level) would cause minor changes in flood elevations upstream and downstream from Normandy Dam. Alternative B (Fountain Creek Reservoir) would involve construction and operation of a new dam. Upstream flood elevations would be increased substantially and impacts on downstream flood elevations would have to be determined once the specific design of the project was available. Natural and beneficial floodplain values would be destroyed in the area covered by the reservoir pool and new floodplain areas would be created upstream of the dam.

5.8 TERRESTRIAL LIFE

Information presented in Section 4.8 indicates that a wide variety of terrestrial habitats and species occur in the areas where the water supply alternatives could be built. The most common terrestrial habitats in these areas are associated with agricultural development and other human modifications of the natural communities that once occupied these parts of

the Central Basin and Highland Rim. Remnant areas of natural habitats, including cedar glades and other unusual communities, still occur throughout this area. Under most of the alternatives, construction activities would occur on small sites and in narrow corridors and would result in only short-term and local effects on widespread and common terrestrial species. If one or more of the action alternatives was proposed to be built, the subsequent review of the detailed plans would confirm that only widespread communities would be affected or would address any potential effects to unusual natural communities.

The following paragraphs focus on the potential effects of each of the water supply alternatives.

Alternative A - Continue to use Present Sources (No Action)
This alternative would not have any effect on terrestrial life because no facilities would be built to provide additional water for the Columbia area. If the demand for water increases as expected in future years, additional withdrawals from the Duck River or whatever other alternatives are developed to meet the additional needs of the human population might eventually have some effect on terrestrial plant and animal communities.

Alternative B - Fountain Creek Reservoir
Construction of a reservoir on the downstream part of the Fountain Creek watershed would displace all of the existing terrestrial communities in the area that would be flooded. Available information suggests that the plants and animals which occur in this area are common and widespread species in middle Tennessee and would not be adversely affected by the loss of these populations. If this alternative was proposed to be built, field surveys would be conducted to confirm this determination; however, if unique communities or unusual species were found, appropriate measures would be included in the project to address any potential adverse effects to those communities or populations. In addition, planning for the project should include activities to protect and enhance natural communities and species populations on the land surrounding the reservoir. Invasive plant species management, plantings to enhance wildlife species, and long term planning to reverse forest fragmentation also should be considered as important parts of the ancillary activities associated with this project.

Alternative C - Downstream Water Intake

The construction of a water intake and pumping station along the Duck River west of Columbia and the construction of a pipeline and a booster station largely along existing highway rights-of-way are unlikely to have more than local and short-term adverse effects on terrestrial life. The plant and animal species known to occur in these areas are widespread and common throughout middle Tennessee. If this alternative was proposed to be built, field surveys would be conducted to locate any uncommon terrestrial communities or species in the impact area and, if any are found, appropriate avoidance or minimization measures would be included in the project plans.

Alternative D - Raise Normandy Dam

The vegetation and animal communities which occur around Normandy Reservoir are thought to be common and representative of that portion of Tennessee. If this alternative was proposed to be built, it is unlikely to cause more than local adverse effects on these species or their populations in the area. To confirm and support this initial determination, the actual areas that would be affected by the modification of the dam and higher pool level in the reservoir would be surveyed for the presence of caves and uncommon terrestrial plant and animal species before any construction activity begins. If important surface or cave communities or unusual populations were found, appropriate measures to avoid or minimize any adverse effects to them would be included in the project.

Alternative E - Tims Ford Pipeline

Construction of a water intake and pumping station on Tims Ford Reservoir and an associated pipeline largely along existing highway rights-of-way to discharge into the Duck River near Shelbyville are unlikely to have more than local and short-term adverse effects on terrestrial life. The plant and animal species known to occur in these areas are widespread and common throughout middle Tennessee. If this alternative was proposed to be built, field surveys would be conducted to locate any uncommon terrestrial communities or species in the impact area and, if any were found, appropriate avoidance or minimization measures would be included in the project plans. Along the southern part of this area, particular care would be given to surveying seepages and possible caves which might support unique communities or uncommon species.

Comparison of Alternatives

The available information suggests that, even though none of the five alternatives would have significant long-term effects on terrestrial plant and animal communities, some alternatives would have less effects than others. Alternative A (No Action) would not involve any effects on terrestrial life because no facilities would be built. Alternatives C (Downstream Water Intake) and E (Tims Ford Pipeline) would have only localized and short-term effects on terrestrial plant and animal populations during the construction of the pipelines and associated facilities. Alternatives D (Raise Normandy Pool Level) and B (Fountain Creek Reservoir) would involve construction activities and long-term modifications in areas around an existing reservoir or to create a new reservoir; however, less habitat modification would occur around Normandy Reservoir under Alternative D than would occur where a Fountain Creek reservoir would be built under Alternative B.

5.9 ENDANGERED AND THREATENED SPECIES

The information presented in Section 4.9 indicates that 115 species (68 plants and 47 animals) reported from the five counties in this general project area are now protected under federal and state endangered species laws. Of these 115 species, 21 (4 plants and 17 animals) are protected under the federal Endangered Species Act. A number of the protected species reported from these counties either have not been seen in this area in over 50 years or are unlikely to occur where the action alternatives could affect them. For example, among the 21 federal protected species, only 11 species (one plant, and 10 animals) are likely to occur in the possible project areas (Table 15).

Although some of the protected species reported from these counties (such as the bald eagle and the Indiana bat) can occur in a wide variety of habitats, most protected species are typically associated with specific habitat types. Information presented in Appendix C and summarized in Section 4.9 indicates that 35 of the protected species (30 percent) occur in rivers and creeks, 31 (27 percent) occur in wet meadows, creeksides, and seepage areas, 21 (18 percent) occur in bottomland and mixed hardwood forests, and 13 (11 percent) occur in cedar glades. The fact that these four broad habitat types are the most likely places to find 89 percent of the protected species reported from this five-county area is useful in evaluating the potential effects of each alternative.

The likely effects of the alternatives on all of the aquatic and terrestrial life in the project area are presented in Sections 5.5 and 5.8. The initial evaluations of possible impacts on protected species described in the following paragraphs assume that the projects would be built before any changes would have occurred in present laws, regulations, or knowledge about the status of these plants and animals. While this assumption applies to all of the sections in this chapter (see Section 5.1), its limited value is particularly important with regard to protected species. New information about the distribution and habitat requirements of protected species is continually being discovered and several species which occur in this area could be either added to or removed from the federal and state protected lists before any of the action alternatives would have to be built. Whenever one or more of the action alternatives was designed and proposed to be constructed, an up-to-date evaluation of the potential for impacts on protected species would have to be part of the more detailed environmental review of the project. If federal agencies or federal endangered or threatened species could be involved, the more-detailed, up-to-date, evaluation also would have to be reviewed by the USFWS in accordance with the Endangered Species Act.

Alternative A - Continue to use Present Sources (No Action)

If no new water source was developed for the Columbia area, there would be no effects on endangered, threatened, or other protected species. If the need for water in the Columbia area increases beyond what could be withdrawn from the adjacent part of the Duck River without degrading its other uses, the approach used to meet area needs during drought conditions could have adverse effects on any protected species living in the affected area. The potential effects that action might have on protected species would have to be evaluated and, if appropriate, reviewed by the USFWS when it was being proposed.

Alternative B - Fountain Creek Reservoir

The construction of a reservoir in part of the Fountain Creek watershed would substantially modify the existing aquatic and terrestrial habitats in the proposed reservoir pool area and on the surrounding land. At present, no endangered or threatened aquatic species are known from the stream habitats in the likely reservoir area; however, at least one federal endangered plant (leafy prairie-clover, *Dalea foliosa*) and a variety of state protected terrestrial plants and animals are known to occur in cedar glades

and other habitats on land surrounding the possible reservoir. If this alternative was proposed to be built, appropriate measures would be included in the construction plans to avoid and protect cedar glade habitats where endangered and other protected plants occur. In addition, field surveys would be conducted during appropriate seasons of the year to search for previously unknown populations of federal- or state-listed species which could be adversely affected by construction of the project.

Once the project was built, management of the reservoir and the surrounding land probably would be required to include activities to protect and enhance any federal- or state-listed endangered or threatened species in the area. Depending on water levels and land use in the area, some protected species (presently including bald eagles, gray bats, and Indiana bats) could have additional forage and roosting habitats. Habitats around the reservoir in which protected species occurred (such as cedar glades) would be protected as part of the management plan for the land. Similarly, the quality and quantify of water released from the reservoir would be controlled to avoid adverse effects on any protected species living in Fountain Creek downstream from the dam or in the adjacent reach of the Duck River. Withdrawing enough water to meet all of the water needs of the Maury/southern Williamson County Water Service Area from a Fountain Creek reservoir would result in substantially increased flows in the part of the Duck River in the Columbia area. If other aquatic habitat characteristics were suitable, protected aquatic species might become established in this area.

If this alternative was to be built, known populations of the leafy prairie-clover in the area would have to be protected and enhanced. In addition, site-specific surveys might have to be conducted to update whether other suitable habitats in the affected area support populations of endangered or threatened species. If any potential adverse effects to endangered or threatened species could occur, those potential effects would be addressed during the subsequent review of the project once it was described in more detail.

Alternative C - Downstream Water Intake

Construction of a water intake and pumping station near Duck River Mile 100 and an approximate 13-mile pipeline and booster station to connect the intake to a treatment plant and the existing water distribution system

would not be likely to have adverse effects on federal endangered or threatened species because no federal protected species are known to exist within the habitats through which this project might be built. Several state-listed species and an identified candidate for federal protection (the slabside pearlymussel, *Lexingtonia dolabelloides*) are known to exist in Maury County (see Appendix C) and could be impacted by the project if it affected habitats in which they occur.

The operation of this possible additional water intake near Duck River Mile 100 is not expected to have adverse effects on protected terrestrial plants and animals and could lead to beneficial effects on protected aquatic species. As indicated in Section 5.5, the projected withdrawal of as much as 31 cfs of water from that part of the river is unlikely to have adverse effects on aquatic life, including resident endangered or threatened species, because it would constitute no more than a 21 percent reduction in the minimum flow in the river at that location. In addition, the use of this intake could raise the minimum flow level and improve conditions for protected species in the first few miles of the river downstream from the Columbia water intake.

These initial determinations about the potential effects of this alternative on endangered and threatened species would have to be reviewed as part of the subsequent evaluation when details of the proposed project were known. Site-specific surveys might be required to determine if suitable habitats along the project route did support populations of federal- or state-listed endangered or threatened species.

Alternative D - Raise Normandy Pool Level

Construction activities associated with raising the height of Normandy Dam, raising or relocating facilities around the reservoir, and preparing part of the present reservoir shoreline to be flooded would be unlikely to have adverse effects on endangered, threatened, or other protected species. Most of the habitats that would be disturbed are unlikely to support populations of protected species. Some unusual habitats or populations of protected species might occur within or adjacent to the shoreline area that would be flooded. When specific changes were proposed for the Normandy Reservoir pool level, field surveys would be conducted during the appropriate seasons of the year to document whether any federal- or state-listed species actually could be impacted.

Operation of Normandy Reservoir at a higher maximum pool level would be unlikely to affect any protected species populations around the reservoir that were not affected by the construction work. As indicated in Section 5.5, the increased minimum flow in the Duck River downstream from the dam could result in beneficial effects on aquatic life, potentially including any protected species that were present. The potential effects of this alternative on endangered, threatened, and other protected species would have to be confirmed during the subsequent environmental evaluation of the specific plans for this project.

Alternative E - Tims Ford Pipeline

Construction of a water intake and pumping station in one of the northern embayments of Tims Ford Reservoir and an approximate 20-mile pipeline and booster station to pump water to a discharge point on the Duck River near Shelbyville would be unlikely to have adverse effects on endangered, threatened, and other protected species because no federal protected species are known to exist within the habitats through which this project might be built. Any construction-related impacts on state-listed endangered or threatened species known or likely to occur in the specific impact areas would be temporary and avoidable.

The operation of this pipeline during drought conditions is unlikely to affect protected species in and around Tims Ford Reservoir because the withdrawal is projected to have only a minimal effect on the reservoir level. As indicated in Section 5.5, the additional amount of flow in the Duck River could help prevent drought-related adverse impacts to aquatic life, including any resident protected species. If this additional flow was added upstream from the Shelbyville wastewater discharge (River Mile 221), it could make the adjacent reach of the river more suitable habitat for endangered and other protected species. These determinations about the potential effects of this alternative on protected species would have to be verified as part of the more detailed environmental review of the specific project components.

Comparison of Alternatives

Information presented in the preceding parts of this section suggests that adverse biological effects associated with building the pipelines and associated structures probably can be avoided or minimized. Effects associated with the operation of the water withdrawal or transfer systems

appear to be either minor or, in places, could be beneficial to protected aquatic species. At present, the potential for adverse effects of the alternatives seems to be related to the amount of natural habitat that would be destroyed or permanently modified.

These generalizations suggest that Alternatives C (Downstream Water Intake) and E (Tims Ford Pipeline) would be the least likely to have adverse effects on protected species because they would involve the fewest long-term changes in the terrestrial and aquatic habitats. Alternative D (Raise Normandy Pool Level) appears to have somewhat more potential for adverse effects, mostly because it would involve the flooding of additional land around Normandy Reservoir. Among the action alternatives, Alternative B (Fountain Creek Reservoir) seems to have the most potential for adverse effects on protected aquatic species because it would involve the conversion of natural terrestrial and flowing-water aquatic habitats into standing-water conditions of a reservoir. Depending on water levels and land use around this reservoir, bald eagles and endangered bats might gain some additional forage and roosting habitats.

The potential effect of Alternative A (No Action) on endangered and threatened species is difficult to compare with the action alternatives because, if the projected need for water in the Columbia area does develop, some source would have to be developed. There is no way to predict how that need would be met and what the effects of that action would be on protected species.

On September 19, 2000, TVA submitted a copy of the draft EIS to the USFWS and requested their concurrence with a determination that this programmatic evaluation of possible impacts of future water supply projects would not have any effects on federal endangered and threatened species. On December 20, 2000, the USFWS sent a letter to TVA concurring with that determination, in part because detailed, site-specific endangered and threatened species studies would have to be conducted if any of the alternatives were proposed to be built (see Appendix E).

5.10 LAND USE/PRIME FARMLAND/COMMUNITY NOISE

The present uses of the land, the occurrence of prime farmlands, and the typical community noise patterns in this project area are all described in

Section 4.10. For most of the action alternatives, a majority of the potential impacts to existing land use and noise patterns would occur during the construction of the intakes, pumping stations, and pipelines that would be involved in harvesting water and moving it to where it would be treated and used. Generally, these construction effects would be temporary disruptions in the land use and noise patterns, and these patterns would return to pre-construction conditions within a few days or weeks after the construction work was completed. Where new buildings or other surface facilities such as intakes or pumping stations would be built, small areas would be affected by long-term changes in land use and operating noise levels. In many cases, the location and design of these facilities could include ways to avoid or minimize impacts on adjacent uses.

Alternative A - Continue to use Present Sources (No Action)

If this alternative was followed, there would be no immediate impact on land use, prime farmland, or noise levels in the project area. If no additional water source was developed and the demand for water in the Columbia area did increase beyond the amount that could be withdrawn from the Duck River, industrial, commercial, and residential development would be unlikely to alter the present use patterns in the area.

Alternative B - Fountain Creek Reservoir

The construction and operation of this alternative would have the greatest impact on land use, prime farmland, and community noise patterns among the four action alternatives. As described in Section 3.4, the reservoir property (including necessary flood storage capacity) would occupy approximately 3,600 acres of land. Approximately 2,800 acres of this land already is in public ownership; however, approximately 800 acres of land now in private ownership would have to be acquired. All cemeteries within the project area would have to be relocated, and all of the homes, affected roads, and other developed structures would have to be moved or prepared for flooding. Existing uses of the land in the affected area would be converted to water supply use, including land which is now occupied by prime farmland soils. The final amount of land that would be included would be determined during the detailed planning process and would depend on the specific purposes of the project. Detailed planning toward the construction of this alternative would have to include the completion of Form AD 1006 with assistance from the U.S. Department of Agriculture's

Natural Resource Conservation Service to determine the rating associated with the prime farmland conversion that would be involved.

Construction activities associated with clearing the reservoir land and building the dam and other components of this project would generate noise that would be heard in the affected areas. This noise would be generated primarily by heavy equipment such as trucks, bulldozers, and earthmovers. It would be similar to the noise presently produced by the rock quarry and crushed stone operation along Blue Springs Road. The noise level probably would peak during the period when the reservoir was being cleared and when earth and rock were being hauled to the dam site. Along the pipeline route, noise levels would peak during the excavation and refilling of the construction trench. The noise level could be lessened by restricting construction to daylight hours and by requiring proper maintenance of engines and muffler systems. The construction noise might be annoying to some neighboring residents, but would not be hazardous to their hearing.

Once the reservoir was built, the purposes of the project would have a substantial effect on the use of adjacent land, including any prime farmland that was present, and on the noise levels that could occur. Development of the land surrounding the reservoir for residential, recreational, or commercial use could encourage the conversion of adjacent land to similar uses. Restrictions on the use of land within the project area (for example, intended to protect the quality of the water supply -- see Section 5.4), might minimize any change in the present uses of the surrounding land. Wide-ranging restrictions or zoning changes on the reservoir property (for example, to further protect the quality of the water supply) might lead to more controlled uses of the land adjacent to this project area. Each of the possible uses of the reservoir land would result in different noise levels, most likely related to the types and amount of recreational use that would occur. Substantial recreational activity could result in engine noise from boats and personal watercraft that would be heard in the areas immediately around the reservoir. If this alternative was proposed to be built, the potential land use and noise aspects of the project would be addressed during the more detailed evaluation of the specific proposal.

Alternative C - Downstream Water Intake

The construction of an intake, pumping stations, and a pipeline that would transport water from the western part of Maury County more or less along

State Highway 50 to a treatment plant near Columbia could have short-term adverse effects on land use, prime farmland, and community noise levels. Construction of these facilities would involve clearing areas, excavating a trench, laying the pipeline, and restoring the work site (see Section 3.4); however, the location, design, and construction of these facilities should be adaptable enough to avoid or minimize those effects on existing land uses. If the permanent use of more than 10 acres of land would be required for this alternative, then Form AD 1006 would have to be completed to determine the rating associated with the conversion of prime farmland. During construction of the pipeline, heavy equipment use, blasting, and increased truck traffic would raise local noise levels. These effects could be lessened by restricting construction to daylight hours and by requiring proper maintenance of engines and muffler systems.

Operation of the pumping station would involve some noise associated with the use of electric motors and pumps. Noise emissions from the facility could be reduced to insignificant levels if low-noise equipment was specified and if the buildings were designed and constructed to absorb and block escaping noise. Properly located, designed, and constructed, this alternative would have insignificant effects on land use, prime farmland, and noise.

Alternative D - Raise Normandy Pool Level

Raising the pool level on Normandy Reservoir would involve increasing the height of the dam structure and modifying or replacing existing roads and recreation facilities around the reservoir. Existing trees and other vegetation also would have to be removed from the band of land around the reservoir that would become part of the enlarged pool. The affected area is all part of the Normandy reservation and there would not be any change in the use of most of the land (however, see Section 5.11 concerning changes that would occur at recreation sites and a natural area).

Construction activities related to raising the dam and modifying the roads, bridges, and recreation facilities around the reservoir would generate noise impacts in the immediate areas of the work sites. This construction noise would come from the trucks and other heavy equipment involved in these activities. The overall impact of the noise could be reduced by minimizing the length of the construction period and having the heavy equipment operate only during daylight hours. Noise emissions also could be reduced

by requiring the engines and mufflers to meet manufacturers original specifications and appropriate maintenance programs. The operation of this alternative would not include any additional noise effects.

Alternative E - Tims Ford Pipeline

The construction of an intake, the pumping stations, and a pipeline that would transport water from Tims Ford Reservoir more or less along State Highway 82 to empty into the Duck River near Shelbyville could have short-term adverse effects on land use, prime farmland, or community noise levels. Construction of these facilities would involve clearing areas, excavating a trench, laying the pipeline, and restoring the work site (see Section 3.4); however, the location, design, and construction of these facilities should be adaptable enough to avoid or minimize those effects on existing land uses. If the permanent use of more than 10 acres of land would be required for this alternative, then Form AD 1006 would have to be completed to determine the rating associated with the conversion of prime farmland. Local noise levels would increase during the construction of the pipeline. These noise effects, generated by heavy equipment, blasting, and additional truck traffic, could be lessened by restricting construction to daylight hours and by requiring proper maintenance of engines and muffler systems.

Operation of the pumping stations would involve some noise associated with the use of electric motors and pumps. Noise emissions from the facility could be reduced to insignificant levels if low-noise equipment was specified and if the buildings are designed and constructed to absorb and block escaping noise. Properly located, designed, and constructed, this alternative would have insignificant effects on land use, prime farmland, and noise.

Comparison of Alternatives

Alternative A (No-Action) would not have any adverse impact on land use, prime farmland, or community noise. The construction of Alternatives C (Downstream Water Intake), D (Raise Normandy Pool Level), or Alternative E (Tims Ford Pipeline) would have short-term adverse effects on these resource areas during the construction period. These alternatives would have little or no long-term adverse impacts on these resources if appropriate measures were taken to avoid or minimize effects on local land uses, areas of prime farmland, and noise emissions.

Construction and operation of Alternative B (Fountain Creek Reservoir) would have the most effect on land use, prime farmland, and community noise. Construction of a reservoir on part of the Fountain Creek watershed would involve buying approximately 800 acres of land, converting approximately 2,200 acres of land from the existing uses to a water supply reservoir, and could affect the use of land surrounding that reservoir. Noise levels in the area would increase during the construction period and, depending upon the specific uses of the area, after the reservoir was completed.

5.11 VISUAL CHARACTER, RECREATION, AND NATURAL AREAS

Information presented in Section 4.11 indicates the visual setting, recreational background, and descriptions of the natural areas which exist in the parts of the Duck and Elk River watersheds that could be affected by one or more of the water supply alternatives. Most of the area has an attractive, harmonious, rural character that supports a wide variety of recreational uses and a diverse group of natural areas. Each of the water supply alternatives could result in some level of impact on these aesthetic, recreational, and natural resources.

Three of the action alternatives would include the construction of various types of intakes, pumping stations, and some length of a pipeline. The types of activities which could occur during the construction of these structures include increased traffic, heavy equipment use, vegetation removal, excavation work, and reclamation of the area. These disruptions would be most likely seen in the foreground by local residents and by motorists using the adjacent highways. The construction work would add temporary visual discord, while reducing coherence and harmony in the rural landscape. Local scenic integrity would be low during the construction period. If these project components were located, designed, and built as described in Section 3.4, the construction activity would only result in short-term effects on visual and recreation resources. Under each of the alternatives involving a pipeline, the detailed planning for the project would include measures to avoid natural areas and minimize adverse construction effects on visual and recreational resources. The overall effects of the proposed measures on these resource areas would be evaluated as part of the subsequent environmental review of the projects.

The operation of the intakes and pumping stations also could result in long-term changes in the character and use of small areas along the streams and in the landscapes where these structures would be built. Visual harmony and scenic integrity might be reduced in the foreground views of local residents, motorists, and others who encounter these structures. These impacts could be minimized with proper attention to the relationship of these facilities to their proposed settings and preexisting uses of the land.

Alternative A - Continue to use Present Sources (No Action)

Initially, at least, following this alternative would not result in any adverse effects on visual character, public recreation, or natural areas. If the anticipated additional needs for water in later years were met by withdrawing more water from the reach of the Duck River at Columbia, temporary adverse effects on water-oriented recreational opportunities could occur in the area. Scenic integrity along the river would be reduced if larger amounts of the bank are exposed for long time periods. The additional withdrawal also could adversely affect the portion of the Duck River Mollusk Sanctuary in the Columbia area (see Section 5.5).

Alternative B - Fountain Creek Reservoir

Construction of a reservoir in part of the Fountain Creek watershed would substantially impact the visual character and recreational use of the project area; however, the Columbia Glade Natural Area would be protected from adverse effects associated with the construction and operation of this reservoir. Removing the existing vegetation, altering the surface water flow, and building the dams and other structures would be highly discordant with the existing rural countryside and would substantially reduce recreational use of the affected area throughout the construction period. The large-scale earthwork, related construction activities, and increased traffic congestion would provide adverse visual contrast, while reducing coherence, harmony, scenic integrity, and tranquillity in the landscape. These visual changes would impact the foreground and middleground views of area residents and motorists using local roads, highways, and bridges.

The completed reservoir would be a major change in the visual landscape character, replacing views of pastures and woodland with a large expanse of water surface. In general, water bodies are highly desired visual assets which enhance scenic attractiveness and the value of properties from which they are viewed. The reservoir would add some uniqueness, variety, and

compatible contrast to the landscape without substantially reducing visual harmony. This reservoir also would provide some negative visual impacts during the summer, fall, and winter seasons including a wide band of bare earth exposed during water supply drawdowns, shoreline erosion, and, possibly, disruption of visual tranquillity by motorized water sports. Homes with foreground views would receive the greatest impact. For those with middleground views, negative impacts would be lessened and positive impacts would be enhanced by the greater viewing distance.

With regard to recreation, the reservoir could provide a variety of lake-oriented opportunities not otherwise available this close to Columbia. The extent of new boating, fishing, and other recreational opportunities on this reservoir would depend on several factors including water level fluctuations, water quality, lake access, and the results of any actions required to protect the water source from potential contamination (see Section 5.4). If this alternative was proposed to be built, all of the potential construction and operational effects on visual resources, recreation, and natural areas would be addressed as part of the environmental review of the specific project that was being proposed.

Alternative C - Downstream Water Intake

Building an intake, pumping stations and a pipeline from somewhere near Duck River Mile 100 to a new treatment plant and the existing water distribution system would likely have only short-term and minor effects on visual character, recreational resources, and natural areas. The possible adverse effects associated with pipeline construction and ways to avoid or minimize them are discussed in the introduction to this section. The construction work would be seen in the foreground by residents and motorists using Highway 50 between Williamsport and Columbia. Scenic integrity would return to a moderate level once construction and reclamation were completed.

Operation of this alternative could have a local impact on visual quality because the intake structure would be a feature essentially out of character with the rural countryside. Recreational uses and natural areas would not be affected by the operation of this intake and pipeline.

Alternative D - Raise Normandy Pool Level

Both the construction and subsequent operation of Normandy Reservoir at a higher maximum pool level could have significant effects on the visual character, existing recreational resources, and adjacent natural areas. During the construction period, the existing landscape character would be disrupted by the work being done on the dam, recreation areas, and bridges, in addition to the vegetation being removed from a band of land all around the reservoir. This visual discord would be seen in foreground views from area homes, local motorists, and boat traffic on the reservoir. Once the modifications were complete, the visual changes might only be discernible to frequent visitors and recreational users who were familiar with water levels and facilities as they had been in the past. Scenic integrity probably would return to a moderately high level after reclamation.

Recreational users on Normandy Reservoir would notice substantial changes associated with raising the maximum pool level because most of the recreational activity around this reservoir is focused on where the water meets the land. As indicated in Section 3.6, raising the maximum pool level would require the modification or relocation of some roads, bridges, boat ramps, and existing facilities in the Barton Springs and Cedar Point recreation areas. Changes in the way water was managed in the reservoir also could lead to changes in the abundance of various fish populations and where they could be found at different times of the year (Section 5.5). During the construction period, many recreation facilities probably would be closed for various lengths of time while modifications were being made. When the construction work was completed, recreational users would have to become familiar with the modified or replaced facilities and new habitat conditions in the reservoir.

Downstream from the dam, the additional flow would improve recreational use of the tailwater, probably including recreational fishing. The additional flow also could provide some habitat improvement benefits to parts of the Duck River Mollusk Sanctuary.

With regard to natural areas, Short Springs State Natural Area extends down to the present summer pool level on Normandy Reservoir. Raising the reservoir level would result in significant flooding and erosion effects on three acres within the floodplain area that supports large populations of many wildflower species which contribute to the importance of this site.

The higher pool level also would adversely affect water levels in the creeks on this natural area and the present foot trail adjacent to the impounded creek shoreline. If this alternative was proposed to be built, these potential adverse effects would be evaluated and addressed during the subsequent review of the detailed project that was being proposed.

Alternative E - Tims Ford Pipeline

Building an intake, pumping station, and a pipeline from one of the northern embayments on Tims Ford Reservoir to the Duck River near Shelbyville would be likely to have only short-term and minor effects on visual character, recreational resources, and natural areas. The potential adverse effects associated with pipeline construction and ways to avoid or minimize them are discussed in the introduction to this section. The construction work would be seen in the foreground by residents, nearby boat traffic in the affected embayment, and motorists using Highway 82 between Flat Creek and Shelbyville. Scenic integrity could return to a moderate level after reclamation of the construction sites.

Operation of this alternative is likely to have few or no adverse effects on visual character, recreational uses, or natural areas. A new intake and pumping facility on a Tims Ford embayment and a new discharge structure on the Duck River could have local impacts on visual quality because one or both structures would be out of character with the existing setting. Operation of this pipeline would not have any adverse effects on recreation or natural areas around Tims Ford Reservoir because little or no change in water levels would occur. The additional flow in the Duck River during drought conditions, however, could provide some benefits to recreational use and the part of the Duck River Mollusk Sanctuary downstream from the discharge point.

Comparison of Alternatives

The information presented in this section suggests that both Alternative C (Downstream Water Intake) and Alternative E (Tims Ford Pipeline) are not likely to have any adverse effects on natural areas and would result in only short-term and minimal adverse effects on visual character and recreational resources.

With regard to the two other action alternatives, both Alternatives B (Fountain Creek Reservoir) and D (Raise Normandy Pool Level) would

involve construction activity over fairly wide areas and would produce a variety of changes in the visual character and recreational potential of the affected areas. The changes which could result from building a new reservoir in the Fountain Creek watershed (Alternative B) appear to have more potential for effects on these resources than would occur during the modifications to the existing Normandy Reservoir (Alternative D). With regard to Natural Areas, Alternative B probably could be built and operated with no adverse effects on the Columbia Glade; however, construction and operation of Alternative D probably would have significant adverse effects on an important part of Short Springs.

Initially, at least, Alternative A (No Action) would have no adverse effect on these resources; however, that situation might not last into the future. If additional water is needed for the Columbia area, some source would have to be developed. The potential long-term effects of whatever that alternative might be cannot be evaluated at this time.

5.12 CULTURAL RESOURCES

The information presented in Section 4.12 indicates that a large number of cultural resource sites occur throughout this 5-county area. In Maury County alone, the available information suggests there are more than 4,000 identified archaeological sites and historic structures. Section 106 of the National Historic Preservation Act requires that any federal project sponsor or permitting agency consider the potential impacts of projects on important cultural resources and take steps to avoid or minimize adverse effects.

While a large number of cultural sites do exist in this project area, nearly all of these sites occupy relatively small plots of ground and could be avoided during the planning phase of many types of projects. Using the results of appropriate preliminary surveys, the locations of intakes, pumping stations, and pipelines could be adjusted to prevent or minimize the disturbance of important cultural sites. Operating under the requirements of the National Historic Preservation Act, federal agency sponsors or permitting staffs would have to consult with the Tennessee State Historic Preservation Office about the plans for any project that could affect cultural resources. Federal agency sponsors also would be required to consult with the state preservation office on mitigation measures that would eliminate or reduce the potential for adverse effects. These requirements would apply to each of

the action alternatives included in this EIS which involved a federal agency, either as a participant or as a permitting agency.

Even though archaeological and other historic resources are known to exist in many parts of this general project area, none of the action alternatives has been developed in enough detail for field crews to know where to survey for cultural resources which could be affected by specific construction activities. Given this lack of site-specific information, it is premature to attempt to describe any adverse effects that might be caused by proposing to build one or more of the action alternatives.

At this stage in the evaluation, however, an initial comparison of the potential for adverse impacts among the four alternatives can be based on the acreage that would have to be disturbed to construct each project. Information provided in Sections 3.4 through 3.7 and summarized in Table 6 indicates that Alternative C (Downstream Water Intake) and Alternative E (Tims Ford Pipeline) would disturb small amounts of land during the construction of intakes, pumping stations, and a discharge point (approximately two acres, each) and more land along the routes of the related pipelines. If the density of cultural sites in these project corridors was relatively consistent, the 13-mile length of pipeline (and approximately 130 acres of land disturbance) associated with the downstream water intake would suggest that Alternative C could have somewhat less potential for impacts on cultural resources than could occur under Alternative E along the 20-mile pipeline (and approximately 200 acres of land disturbance) from Tims Ford Reservoir to the Shelbyville area.

Construction of a reservoir in the Fountain Creek watershed (Alternative B) is estimated to affect approximately 3,600 acres of land. Approximately 230 acres of land would be affected by raising the pool level on Normandy Reservoir (Alternative D). Again, assuming that cultural resource sites are evenly distributed, Alternative B (Fountain Creek Reservoir) appears to have more potential for adverse impacts on cultural resources than Alternative D (Raise Normandy Pool Level).

Alternative A (No Action) would not involve any construction activity and, initially at least, would not have any adverse effects on cultural resources. However, Alternative A also would not meet the projected need for

additional water in the Columbia area and, if that need developed, some action alternative would have to be implemented.

While this perspective might be useful in comparing the potential impacts of these conceptual alternatives, a more detailed evaluation of effects would have to be conducted for any alternative proposed to be constructed. That evaluation would have to include a description of the specific cultural sites which could be impacted, results of the consultations with the State Historic Preservation Office, and any measures which would be taken to avoid or minimize potential adverse effects.

On October 11, 2000, TVA sent a letter to the Tennessee State Historic Preservation Office requesting their concurrence with our determination that completion of this programmatic EIS would have no effect on historic properties and that TVA has met present obligations under Section 106 of the National Historic Preservation Act. In a letter dated October 19, 2000, the State Preservation Office concurred with this determination, in part because the "review is limited to the drafting of the Programmatic EIS for future project implementation. Upon selection, the chosen alternative from the EIS must undergo independent Section 106 review" (see Appendix E).

5.13 SOCIOECONOMICS

Existing population, income, and employment information for the counties included in this project area is presented in Section 4.13. Each of the alternatives could have some effect on population and local economic conditions both during whatever construction period was involved and based on the change in available water supply.

Alternative A (No Action) would not have any immediate effect on population or economic conditions because the water supply in the Columbia area should be adequate until severe drought conditions some time after 2015. However, if the demand for water continues to increase, population growth and economic activity in the area eventually would be impacted, with important negative effects on the local economy. If enough water was not available to meet the increasing needs of the area, population, employment, and income would grow much more slowly than they have in recent years or would not grow at all. New businesses and industries, as well as some existing ones, might choose to locate in other areas where sufficient water

was available. Although some change might be made toward less water-intensive economic activities, the net result could be lower than projected population, income, and employment levels, especially if reliable water supplies were available elsewhere.

Each of the action alternatives would involve some level of construction activity. In general, construction activity would generate short-term positive impacts on employment and income in the area, as well as a range of impacts on community services, local government revenues, and expenses. The duration and extent of the construction benefits would vary with the complexity of the project, more or less matching the projected cost of each alternative. On that basis, proposing to build Alternative B (Fountain Creek Reservoir) would have the most construction benefit, followed in order by Alternative D (Raise Normandy Reservoir Pool), Alternative E (Tims Ford Pipeline), and Alternative C (Downstream Water Intake). A more detailed analysis of the socioeconomic impacts of each action alternative could be conducted when more project-specific details were available.

Proposing to build Alternative D (Raise Normandy Pool Level) is likely to meet the projected need for water through 2035, while Alternatives B, C, or E would meet the needs in the Columbia area at least through 2050, the end of the present planning period. As with Alternative A, whenever enough water was not available to meet the increased needs of the service area, population, employment, and income could grow much more slowly than in earlier years or, perhaps, not grow at all. Near the end of this planning period or 2035 (if Alternative D was completed), water supply agencies would have to conduct a new analysis of future water needs in light of economic conditions and growth projections at that time. The results of that evaluation would indicate how well the existing sources would meet future needs and, if appropriate, how much additional water would be required in the future to avoid adverse effects on the local economy.

5.14 ENVIRONMENTAL JUSTICE

Available information about the percentages of nonwhite and low income residents in this project area is presented in Section 4.14. Construction activities associated with the action alternatives could result in disproportionate impacts on disadvantaged populations depending on how decisions would be made concerning the locations of structures and the

routing of pipelines. The analysis of whether particular segments of the population might be adversely affected would require more information about the locations of structures and proposed pipeline routes than is available at present. That analysis would be conducted as part of the subsequent environmental review of any action alternative proposed to be constructed and depending on the extent of federal agency participation in the project. At this time and based on the data shown in Tables 23 and 24, we do not anticipate disproportionate impacts on any segment of the population.

The lack of an adequate water supply in the area would have negative effects on all segments of the population in the water service area. At this time, there is no reason to believe that future additions to the water supply would be more available to some segments of the population than to others.

5.15 INDIRECT AND CUMULATIVE EFFECTS

This EIS evaluation is the most recent in a long series of studies and projects related to using the Duck River as a water supply source for communities in the upper Duck River watershed. As indicated in Section 2.2, many of the historic low flow problems that once occurred in the Duck River were addressed in 1976 when Normandy Dam started to be used to maintain a higher than natural minimum flow level in the river. Results of the Needs Analysis conducted as part of this project (summarized in Section 2.10) indicate the present amount of minimum flow from Normandy Dam would be enough to meet projected water demands in the Bedford County and Marshall County Water Service Areas through the end of the study period (to 2050). Construction of any one of Alternatives B, C, E, or D (with the inclusion of some water conservation measures) would meet the projected water demands of the Maury/southern Williamson County Water Service Area through 2050. Meeting the projected demands for water in all three service areas for most or all of the next 50 years would eliminate the worry that many local residents have had about an adequate water supply. The cumulative effect of resolving local concerns about the quantity of the water supply probably would make people feel better about their communities and would allow economic growth to proceed at or near the Additional Development rate included in Table 2.

This evaluation also indicates that people living in and around the upper Duck River watershed have no other choice but to depend on the river and area reservoirs as their water supply sources, both now and into the future. The amount of water available for use in the Columbia area is, and will be, dependent on how much water is released from Normandy Dam (and any other dams feeding into the watershed), and how much water is withdrawn from and not returned to the river between Normandy Dam and the Columbia area. The quality of the water in the Columbia area also is and will be dependent on the types and amounts of nutrients and other materials that are allowed to flow into the river from point sources and from the land all along the creeks and the river upstream from the water intakes. Especially as more and more people move into the area, everyone in the watershed will have to realize that protection of the quantity and quality of the water supply will be critical to their health and the local economy. People living in different parts of the watershed also will have to work together to make sure each community has enough good quality water to meet their needs. The cumulative effect of this part of the evaluation will depend on how well individuals, communities, and agencies in the area understand this relationship and act on it to encourage or require cooperation among the water use organizations.

As indicated in Section 3.8, water conservation is just beginning to emerge as an issue (and an opportunity) in Tennessee and other eastern states. In the future, the realization that water resources really are limited may force conservation to become an important component in water resource planning. Present water conservation measures probably could produce at least a ten percent reduction in water use in the Duck River region, especially if people would accept and implement the measures that are already available. The identification of alternatives in this EIS which could meet the projected water demands in the upper Duck River watershed through 2050 might allow people and agencies in the area to virtually ignore water conservation until many years from now. Alternatively, the integrated nature of the reservoirs, river, and the water systems discussed in this document could help local agencies and the public realize they can protect and extend the use of their water sources far beyond 2050 by careful planning and adopting reasonable conservation measures. Only time will tell the cumulative effects of that aspect of this water supply project.

5.16 UNAVOIDABLE ADVERSE IMPACTS

Selection of Alternative A would not involve any additional unavoidable adverse impacts, at least not until severe drought conditions some time after 2015. When water demands in the Columbia area exceed the amount of water that can be withdrawn from the river without affecting other uses, adverse impacts could occur in the Duck River or whatever other source would be affected. If additional withdrawals were made from the Duck River, the potential adverse impacts could affect water quality, aquatic life, and recreational use of the river.

Unavoidable adverse impacts associated with Alternatives B, C, and E would each include the construction of some length of pipeline. Construction of one or more of these pipelines could result in localized, short-term impacts on aquatic, terrestrial, and cultural resources; however, many of those impacts could be avoided or minimized as the detailed plans for the projects were developed. Alternatives B and D would involve the construction or enlargement of a reservoir. In each case, these alternatives could include adverse impacts on water quality, aquatic life, archaeological sites, and historical structures in the areas, some of which could be avoided or minimized with careful planning. Alternative B also would require the acquisition of approximately 800 acres of land presently in private ownership.

5.17 SHORT-TERM USES AND LONG-TERM PRODUCTIVITY

All of the action alternatives included in this EIS are intended to address the long-term needs for water in the upper Duck River basin, especially the Maury/southern Williamson County Water Service Area where additional water is projected to be needed in future years. The evaluation of these alternatives is focused on identifying the full range of potential short-term construction effects and long-term operational impacts that could occur on the environmental and cultural resources in the affected areas. The intent of this analysis and programmatic EIS is to help the DRDA, local water systems, and the public understand the water needs that are projected to occur in this area through the year 2050, the various ways that are available to meet those needs, and the types of environmental effects that could occur if some of the most likely alternatives were proposed to be built. Proposing to build any of the action alternatives would meet the water supply needs of this area through at least 2035; proposing to build Alternatives B, C, or E would meet the needs through 2050.

5.18 IRREVERSIBLE AND IRRETRIEVABLE RESOURCE COMMITMENTS

By itself, this programmatic EIS does not involve any irreversible or irretrievable commitment of resources because it is strictly an evaluation and early planning exercise. Proposing to build Alternatives B (Fountain Creek Reservoir) as described in Section 3.4 could be viewed as involving the irreversible and irretrievable commitment of approximately 2,200 acres of land to become a water supply reservoir. Approximately 56 percent of this land contains prime farmland soils and approximately 10 percent is wetlands (Section 4.10). This area also is likely to contain a large number of archaeological sites (Section 4.12). If a Fountain Creek reservoir was constructed as described in Section 3.4, all of the land would be converted to water supply use and all of the existing archaeological sites and wetlands in the pool area would be inundated (however, some new wetland areas probably would develop around the reservoir – see Section 5.6). Protection of the water supply source also might include restrictions on the use of the land surrounding the reservoir and elsewhere in the Fountain Creek watershed (see Section 5.4). An undetermined amount of rock, earth, other building materials, and fuel would be used in the construction of the reservoir.

Proposing to build Alternative D (Raise Normandy Pool Level) would involve the irreversible and irretrievable commitment of 230 acres of land, some existing wetlands, and archaeological sites during the enlargement of Normandy Reservoir. All of the land potentially affected by that project already is part of the Normandy Dam Reservation. The quantities of rock, earth, other building materials, and fuel that would be used in the modifications to Normandy Reservoir also have not yet been determined.

Both of the two other action alternatives (Alternatives C and E) would require much smaller irreversible and irretrievable commitments of resources to build the intakes, pumping stations, and pipelines they would include. Both of these alternatives also would require long-term commitments of around two acres of land for the intake and pumping facilities and only short-term use of the land surface along the route of the pipelines. Fuel, building materials, and other resources would be used during these projects; however, the quantities that would be involved have not yet been estimated

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